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CONGESTION OF THE HEART,

AND ITS

LOCAL CONSEQUENCES.

BY

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*[From Volume XLIII of the 'Medico-Chirurgical Transactions,'
published by the Royal Medical and Chirurgical Society of
London.]*

L O N D O N :

PRINTED BY

J. E. ADLARD, BARTHOLOMEW CLOSE.

1860.

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Received March 8th.—Read June 26th, 1860.

THE principal object of this paper is to call the attention of the Fellows of the Society to the occurrence of congestion of the muscular tissue of the heart; to the most common and direct consequences of that congestion, viz., induration, toughening, and thickening of the walls of the heart; and to the influence which those changes of texture exercise (as predisposing causes) on the development of permanent dilatation of the heart.

The expression, congestion of the heart, has been hitherto used to signify extreme distension of the cavities of the heart with blood; few pathologists have even mentioned congestion of the substance of the heart, and none have, I believe, so much as adverted to its most important consequences.¹ When the right cavities of the heart are over-

¹ Bertin notices the dilatation of the veins of the heart which accompanies engorgement with blood of the right auricle: "Il (le sang) s'accumule donc dans leur cavité, distend leur parois, et les engorge jusqu'à leurs dernières extrémités." He observes also that rupture of the distended veins may occur. ('*Traité des Mal. du Cœur*,' 1824, p. 41.)

distended with blood from an impediment existing to its onward flow, there is not only engorgement with blood of the *venæ cavæ* and of the veins opening into them, but also of the coronary sinus, veins, and branches. Now, it is a pathological law, that mechanically induced congestion, if long continued, slowly formed, and intermitting altogether or in degree, has for effect induration, and also (when the fibrin exuded is not of the powerfully contractile variety) permanent increase in bulk of the organ or tissue.

Thus, when the inferior vena cava is unable to pour its blood freely into the right auricle, the liver and kidneys are at first enlarged and softened from over-distension of their vessels and effusion of serosity into their structures. If the impediment to the onward flow of the blood be quickly removed, those organs soon recover their normal size and consistence; but, if the impediment continues for any length of time, then the organs in question are found to be indurated, toughened, and (except under the conditions previously specified) permanently enlarged. The induration, toughness, and enlargement, are due, chiefly at least, to an interstitial exudation of lymph, which is found after death, either amorphous, or in the form of granules, or more or less organized into fibrous tissue. It may be that, in particular cases, there is also some true hypertrophy of the proper structure of the congested part.

When the contractile coats of a hollow viscus are indurated, toughened, and thickened by an interstitial exudation of lymph, their normal contractile power is diminished. The consequence is, that although the resistance to over-

Rokitansky has the following remarks on the subject at page 267 of the second volume of the last edition of his '*Path. Anat.* § 7: *Krankheiten der Textur.—Hyperämie:*' "Ein Strotzen der Gefäße des Herzens, zumal seiner Venen und kleine Blutaustretungen in Form von Hirsekorn—Linsengrossen Ecchymosen unter dem Pericardium in der Nähe des Sulcus transversalis, an den Verhöfen und an den Ursprungstücken der Arterienstämme kommen bei Stenosen des Herzens und bei Asphyxien Neugeborner und Erwachsener häufig vor."

distension of the walls of the viscus is greater than natural, yet, if the distending force be sufficient to overcome that resistance, and be repeatedly applied at short intervals over a length of time, permanent and extreme dilatation of the viscus will be produced.

What is true in these respects of other organs and tissues is true of the walls and cavities of the heart. When there is long-continued obstruction to the passage of the blood out of the right ventricle, and consequently impediment to the free entrance of the blood from the coronary sinus into the right auricle, congestion of the walls of the heart follows. If the impediment to the exit of the blood from the sinus be slowly produced, be moderate in degree and permanent, or be frequently repeated, then induration, toughening, and thickening of the walls of the heart will ensue, and permanent dilatation of its cavities be the final result; the over-distension of the walls of the cavities being the immediate cause of the dilatation—the induration, toughening, and thickening being the cause of the permanence of the dilatation.

The peculiarities of the indurated and toughened walls of the heart are as follows:

When divided across, the outer wall does not fall inwards, the form of the cavity being still retained, even though, as is sometimes the case, the walls are (in consequence of the extreme dilatation of the cavity) thinner than natural; the cut surface of the muscular tissue has a very smooth, compact, homogeneous appearance; the *columnæ carneæ* stand firmly out; the tissue is harder than natural, and singularly tough. This tough, leather-like quality is one of the most marked characters. The colour of the indurated, toughened tissue may be paler or darker than natural.¹

The microscopical appearances of the indurated and toughened tissue are—

1st. The *striæ* of the muscular fibres are generally

¹ Laennec described several of these characters as proper to the dilated and hypertrophied heart. *De l'Auscult. Méd.*, vol. ii, p. 514.

indistinctly seen, though here and there they are as perfect as in health.

2d. The muscular fibres are more firmly united to each other than in the healthy heart.

3d. Both between and within the muscular fibres are innumerable molecular granules, chiefly protein.

4th. Lymph which has a granular form exhibits in the heart, as elsewhere, a tendency to undergo fatty degeneration, and the muscular fibres of the heart, damaged by the congestion and the presence in and among them of the lymph, are prone to the same change; the consequence is, that it is common to find here and there a considerable number of particles of free olein as well as muscular fibres which have undergone fatty degeneration.¹

5th. In some cases the cellular or connective tissue seems to be increased in quantity.

When the exit of the blood from the right auricle is suddenly or greatly impeded, it is not unusual to find small crimson spots studding the external surface of the heart, and less commonly the internal surface. These spots are evidently extravasations of blood, the result of capillary hæmorrhage from mechanical obstruction to the onward flow of the blood.² Under like conditions there is often found a considerable excess of serosity in the pericardium, and œdema of the loose cellular tissue at the base of the ventricles; the latter especially, if the patient is much emaciated.

When the congestion has been extreme and long continued, the coronary sinus is found to be more capacious than natural.

In studying the effects of congestion on tissues and organs, it is necessary to separate not only slight from extreme congestion, but also continuous from intermitting

¹ When the fatty metamorphosis of the muscular tissue and lymph is extensive and extreme, softening of the walls of the heart may ultimately occur; the parietes of the heart being first indurated, and subsequently softened, in consequence of the indurated tissue undergoing fatty degeneration.

See Rokitsansky, in previous note.

congestion, suddenly formed from gradually formed congestion, and congestion of organs the action of which is normal or increased from congestion of organs the functions of which are less actively performed than in health.

It is the very gradually developed, long-continued, intermitting congestion of organs the functions of which are over-actively performed notwithstanding their congestion, which is especially followed by induration, toughness, and hypertrophy.

The causes which lead mechanically to an accumulation of blood in the right cavities of the heart have been attentively studied, and are well known. They are referable either to disease of the arteries of the heart itself, or to some cause interfering with the free passage of the blood through the vessels of the lungs.

The following cases are sufficient to *illustrate* the main facts adverted to in the foregoing remarks; viz., the most common causes of mechanical impediment to the passage of the blood through the right side of the heart; the relation between those impediments, engorgement of the right cavities of the heart, and congestion of the walls of the heart; the result of that congestion of the cardiac parietes, viz., induration and toughness, especially affecting the parts most in action; and the influence of induration and toughening of the walls of the heart in the production of permanent dilatation of its cavities.

CASE.—A woman, æt. 50, suffered during life from general anasarca, symptoms of extreme congestion of the lungs, liver, kidneys, &c. After death, the walls of the heart were found greatly thickened, and the cavities dilated. When the heart was opened the divided walls still retained their rounded form; they did not fall inwards; the substance of the organ was remarkably tough and hard; the mitral orifice was much constricted; the left auricle was scarcely larger than natural, the right was very capacious; the foramen ovale was so patent as to admit the points of three fingers; the right auriculo-ventricular orifice was very

large (five inches and a quarter in circumference); the coronary sinus and veins were considerably dilated. The orifice of the aorta seemed of normal size, it measured two inches and five eighths in circumference; the orifice of the pulmonary artery was so much dilated as to measure four inches and a half in circumference. There was a large amount of subendocardial and subpericardial extravasation of blood in very thin layers, varying in extent, at some places forming mere specks, at others large patches.

The kidneys were hard, tough, and granular. The liver was remarkably tough and granular, and fibrous at the margin.

The lungs were the seat of pulmonary apoplexy.

When examined by the aid of the microscope, every fibre of the heart was found to be studded, both within and without, with minute granules—the majority protein, a few olein. The fibrous tissue seemed to be more abundant than natural. The cross-markings of the fibres were less distinct than are those of the fibres of a healthy heart.

Remarks.—The primary disease in this woman was evidently narrowing of the left auriculo-ventricular orifice. The blood, thus prevented from readily passing into the left ventricle, must have exerted abnormal pressure on the septum auricularum; as a consequence, it is probable that, an obliquely patent foramen ovale, such as is so often found when no admixture of the blood occurs, became dilated. The pressure on the two sides of the septum being unequal, the blood must have passed from left to right auricle, thus accounting for the difference in the relative size of the two auricles. The large size of the pulmonary artery was, doubtless, due to the impediment to the escape of blood from the pulmonary veins, and to its passage through the lungs.

These changes, as well as the condition of the liver and kidneys, point to the long continuance of the impediment to the circulation; the large size of the veins of the heart, and the extravasation of blood under the visceral pericar-

dium and under the endocardium, show the degree to which the substance of the heart must have been congested during life; the toughness and hardness of the tissue of the walls of the heart were singularly well marked.

CASE.—J. S—, æt. 35, a man of intemperate habits, by trade a carpenter, was admitted into University College Hospital, November 14th, 1860.

On September 6th he had an epileptic fit. On the 16th he was seen by Dr. Coghlan, of Notting Hill, who found, in addition to much cerebral disturbance, a loud, soft, blowing, systolic cardiac murmur, having its point of greatest intensity at the apex; the heart's impulse abrupt and irregular in force and frequency; the pulse at the wrist so rapid, weak, and irregular, that it could not be counted. No anasarca.

Against the advice of his medical attendant the man resumed work, and when again seen he was suffering from extreme dyspnœa and extensive dropsy.

On admission into the hospital, about six weeks after the supposed commencement of his illness, the most prominent symptoms were extreme dyspnœa, anasarca, and ascites.

All the superficial veins were distended with blood. The jugular and subclavian veins became distended to the utmost when the man coughed; they pulsated synchronously with the heart's beat; a strong thrill was perceptible by the finger placed over the point of junction of the right internal jugular and subclavian veins. On slight pressure both the pulsation and the thrill ceased.

Physical signs indicated the existence of hypertrophy and dilatation of the heart, and regurgitation of blood through the right and left auriculo-ventricular orifices. The urine contained a considerable quantity of albumen. The congestion of the various organs and tissues diminished very greatly during the first few weeks of the man's stay in the hospital; so much so that the anasarca almost disappeared; there was scarcely a trace of albumen in the urine; the pulse fell to 96, and was more regular in force and frequency, and the

man could lie on his back, and walk about the ward without difficulty.

For a fortnight before the man's death, on January 4th, 1858, however, the distension of the venous system was even greater than on his admission.

The larger veins were abruptly dilated at intervals, indicating the situation of their valves. There was distinct pulsation of cardiac rhythm in the veins of the arm; pressure on a vein stopped the pulsation on the distal, but not on the proximal side of the point of pressure; the pulsation, therefore, was not transmitted through the capillaries. The thrill in the veins at the root of the neck was very perceptible to touch, it was synchronous with each beat of the heart. A loud systolic murmur, evidently generated in the veins, was audible at the spot where the thrill was to be felt. There was neither thrill nor murmur in the carotid or subclavian arteries.

At two points, where the bulging of the brachial vein attained the size of half a broad bean, the pulsation of the vein was perceptible to touch as well as eye.

There was orthopnoea, extreme anasarea, and ascites.

After death about eight ounces of reddish serosity was found in either pleura, and ten ounces in the pericardium.

The heart was much larger than natural. The right auriculo-ventricular opening measured six and a quarter inches in circumference. The left auriculo-ventricular opening was so much contracted from old disease of the mitral valve, that even the points of two fingers passed through it with difficulty. All the cavities of the heart were much dilated; that of the left ventricle, however, less so than the others.

The walls of the heart were thicker and much harder and tougher than natural. When cut across they did not fall inwards, but the cavities still retained their rounded form unchanged.

The coronary sinus was very capacious; the right internal jugular vein was enormously dilated; the valves at its orifice were perfect, as were the valves of the veins of the arms.

There was no disease of the aorta itself, and only adhesion to a trifling extent of two adjacent aortic sigmoid valves to each other.

The aortic orifice measured three inches in circumference. The pulmonary artery measured three inches and a half in circumference.

The liver was small, but singularly tough ; it was strongly granular ; the tissues of the portal canals were especially thick and tough ; the acute margin of the organ was reduced to fibro-cellular tissue. The kidneys were exceedingly hard and tough, and finely granular. The lungs were the seat of pulmonary apoplexy and congestive pneumonia.

Remarks.—The starting point of the disease of the heart in this case evidently was at the mitral orifice ; to this all the other diseased states of the organ were mechanically referable. The disease of the mitral orifice was doubtless, notwithstanding the history, of long standing.

How extreme must have been the impediment to the passage of the blood through the right side of the heart, was shown by the remarkable fulness of the superficial veins. The distension of the right jugular vein was so great that the valves at its opening into the subclavian vein no longer sufficed to close the aperture, and regurgitation was permitted ; in the same way as regurgitation was permitted through the dilated right auriculo-ventricular orifice from insufficiency of its healthily sized valves to close the abnormally large aperture. The thrill felt at the root of the neck, and the systolic murmur heard at the same point, were evidently due to the same cause, viz., to the flow of blood past the margin of the valves into the dilated jugular vein.

That the same cause which had led to the distension of the visible veins, viz., the impediment to the escape of blood from the right side of the heart, had also led to distension of the veins of the heart, was shown by the dilatation of the coronary sinus and the amount of serosity in the

pericardium. The condition of the liver and kidneys indicated that they were the seat of the exudation of contractile lymph, favoured by, if not the direct result of, their mechanical congestion. The induration and the toughness of the heart were so great that the attention was at once arrested by them.

CASE.—T. B—, æt. 9. This boy had from a very early period of his life been the subject of well-marked cyanosis, and some time before death suffered from a considerable amount of anasarca.

After death, in the *pericardium* was found rather more than two ounces of transparent serosity, and its tissue was more opaque and thicker than natural. Here and there beneath the visceral pericardium were crimson spots due to extravasation of blood; there was a good deal of serosity in the loose cellular tissue at the base of the heart, *i.e.* between the auricles and ventricles.

The *right auricle* and *venæ cavæ* were filled with recent clots and fluid blood. In the appendix of the auricle was an old clot, and a clot also of some age was interlaced among the *columnæ carneæ* of the *right ventricle*.

The *left auricle* contained much fluid blood, and in its appendix was an old clot.

The *left ventricle* was almost filled with old clot; at first sight it looked as if a fungous growth was sprouting upwards from the apex. A recently formed clot extended from the old clot into the aorta.

The *right and left sides of the heart*, both auricles and ventricles, were greatly dilated, and their walls thickened. The *valves* were quite healthy.

Dimensions of orifices—aortic, $1\frac{7}{8}$ ths inch; pulmonary artery, $2\frac{1}{2}$; left auriculo-ventricular, $3\frac{1}{8}$ th; right auriculo-ventricular, $4\frac{1}{8}$ th. The weight of the heart, with the old clot in the left ventricle, $7\frac{3}{4}$ ounces.

The *coronary sinus* was of very large size.

The liver, spleen, and kidneys were all remarkable for their hardness and toughness.

As far as could be ascertained this boy had been the subject of cyanosis from his earliest infancy. The long duration and the extreme degree of the impediment to the circulation through the lungs and right side of the heart were shown by the large size of the pulmonary artery and tricuspid orifices and of the coronary sinus, as well as by the state of the liver and kidneys. That there was no great cardiac impediment to the circulation at the time of birth was proved by the closure of the foramen ovale. The sub-pericardial hæmorrhage, and the œdema of the cellular tissue at the base of the heart, indicated a sudden extreme increase in the obstacle to the circulation.

Remarks.—It is probable that the primary affection was endocarditis of the apex of the left ventricle occurring very soon after or shortly before birth; that coagulation of blood on the roughened surface followed, and that to the clot so formed the impediment to the circulation was due. The enlargement, hardness, and toughness of the abdominal viscera evidently resulted from their mechanical congestion. Can we doubt that the extreme induration and toughness of the walls of the heart were due to the same cause?

CASE.—J. R—, æt. 47, a cabman, of intemperate habits, was admitted into University College Hospital, November 17th, 1857, suffering from extensive and extreme hypertrophous emphysema of both lungs, capillary bronchitis, and hypertrophy and dilatation of the heart, more especially affecting its right side.

The man stated that he had been for many years subject to winter cough, and that he had previously had five or six attacks of bronchitis, the last about a year ago; that his breath was always short, and his face and lips dusky purple in colour; that a year since he first observed that his legs were swollen, and shortly after that his abdomen was larger than natural; that he vomited a little blood two years ago, had often coughed up mucus streaked with blood, and had suffered repeatedly from epistaxis.

He dated his present illness from the 9th of November, when he had rigors, followed by heat of surface, thirst, increase of cough, and dyspnœa, and was obliged to take to his bed.

When I saw him after he entered the hospital he was suffering from extreme orthopnœa. The whole surface was livid. The vessels of the conjunctivæ were dilated and filled with blood; the eyeballs were prominent, the lower lip swollen and everted. The large veins of the neck, which during inspiration were scarcely perceptible, were distended during expiration, but did not pulsate. The heart's sounds were not audible, though its pulsations were perceptible below the ensiform cartilage. There were present all the physical signs of extreme, extensive hypertrophous emphysema. There was some anasarea. The pulse was 132, very small and weak; the respirations were 38 in the minute. The urine contained a large quantity of albumen, and some small waxy casts.

On the 18th of December the colour of the man's face, trunk, and extremities was darker, *i. e.* he was more cyanosed, than I ever saw the skin of a patient who was not the subject of congenital heart disease.

The lividity varied in degree during the succeeding fortnight. On the 28th the veins of the neck were constantly much distended, and pulsated; there was a large quantity of fluid in the peritoneal cavity; the anasarea had increased in amount; there was a systolic murmur audible at the base of the sternum, *i. e.* just above the ensiform cartilage.

On the 30th my notes were—Cyanotic symptoms more marked than at any time since admission. Heart's beat lower. Left lobe of the liver considerably depressed by the manifestly over-distended right side of the heart and the emphysematous lungs. Veins of neck extremely full, knotted, pulsating.

The man died on the 31st.

On examination after death there was found extreme hypertrophous emphysema of both lungs; great hypertrophy and dilatation of the right side of the heart, moderate hyper-

trophy and dilatation of the left side. The walls of the heart were indurated and very tough; this change affected the right side infinitely more perfectly than the left. The muscular tissue of the right side of the heart was very compact, and the cut surface particularly smooth and homogeneous in appearance. The mitral orifice measured $4\frac{1}{2}$ inches in circumference; the tricuspid, $5\frac{1}{2}$ inches; the aortic, 3 inches; the pulmonary artery, $3\frac{1}{2}$ inches. The coronary sinus admitted the little finger with facility; it was evidently much dilated. There was general anasarca, and a considerable amount of fluid in the peritoneal cavity.

The liver was enlarged, it weighed fifty-two ounces. It was uniformly and finely granular; it was hard and very tough. The kidneys were large and irregularly contracted, so as to be coarsely, unevenly granular on the surface. They weighed six ounces each.

Remarks.—This case affords a good example of the most common causes of over-distension of the right cavities of the heart, and therefore of congestion of the walls of the heart, and, as a consequence, of induration, toughening, and permanent dilatation of the heart; viz., repeated attacks of bronchitis and hypertrophous emphysema. The congestion of the whole venous system showed the great impediment that existed to the flow of blood through the right side of the heart; and the extent to which the capillary system had suffered dilatation proved the length of time that the impediment had existed. The anasarca and the large size of the coronary sinus supported the same inferences.

The liver and kidneys were all enlarged, hard, and tough—changes doubtless chiefly due to their long-continued mechanically produced congestion. The fluid in the peritoneum and the albumen in the urine were also, probably, due to the obstacle to the return of blood from the liver and kidneys. The induration of the heart was very decided; the specific gravity of the most markedly indurated part of the right ventricle was taken for me by Mr. Russell, in Professor Williamson's laboratory; it was 1.053.

The very trifling evidence of old pulmonary collapse found after death, and the enormous extent and degree of the emphysema, conjoined with the fact that, during life, there was very forcible protrusion of the intercostal spaces above the level of the ribs, and equivalent prominence of all the soft parts of the thoracic parietes in violent expiration, told strongly in favour of the expiratory theory of emphysema laid before the Society by myself in 1857.

CASE.—Robert W—, aged two years, was a healthy child till the commencement of 1858, when, his mother said, he suffered from bronchitis. During that attack she noted that his feet were swollen. All œdema disappeared in the course of the ensuing spring, but he never recovered his previous state of health.

The child was admitted into the Hospital for Sick Children on January 30th, 1859—his mother stating that his present illness was of only three days' duration.

There were present the physical signs of general but imperfect solidification of both lungs; strongly marked pulsation in the jugular and subclavian veins; a little lividity of the lips; œdema of legs, hands, and face. The child was seized with convulsions on the 1st of February, and died.

After death the whole of both lungs were found to be loaded with gray granulations and yellow tubercles; and here and there, in addition to much collapse, were nodules of lung solid from pneumonia.

About two drachms of serosity were found in the pericardium; the veins on the surface of the heart were filled with blood.

The pulmonary veins, the venæ cavæ, both auricles, the right ventricle, the pulmonary artery, and the aorta contained a large quantity of dark, loosely coagulated blood. The walls of the right ventricle were only slightly thicker, but were much tougher and harder than natural. The walls of the left ventricle were much less tough and hard than were those of the right ventricle, and its cavity was not dilated.

Examined by the aid of the microscope, the muscular

fibres of both ventricles were found to be studded within and without by protein-granules. A few of the muscular fibres were in a state of fatty degeneration. The most completely degenerated fibres were found in the muscular band which passes from the right wall to the septum ventriculorum.

The spleen, liver, and kidneys, were all loaded with blood, and tougher than natural.

Remarks.—Here the primary impediment to the circulation of the blood was seated in the lungs. Bronchitis, pulmonary collapse, emphysema, and an enormous accumulation of tubercles in every part of the lungs, were the causes of the obstacle; the degree and duration of the impediment were indicated by the dilatation of the right auriculo-ventricular orifice, by the state of the spleen, of the liver, of the kidneys, and of the veins, and by the anasarca.

The texture of the heart was damaged in the same mode and from the same cause as was the texture of the liver, spleen, and kidneys, *i. e.* from mechanically produced venous congestion.

CASE.—E. B—, aged eight years and nine months, was admitted into the Hospital for Sick Children on September 10th, 1859. In November, 1856, she suffered from severe rheumatic fever, and from that time had been obliged to cease her occupation, viz., that of a tight-rope dancer. When she came under my care she was suffering from extreme anasarca, ascites, great fulness and pulsation of the veins of the neck and upper extremities, and orthopnoea. The chest was in form the type of that which accompanies great hypertrophy and dilatation of the heart in a child. The physical signs indicated very plainly the lesions found after death.

She died October 3d, 1859; the body was examined twelve hours after death. The sternum being removed, the tissues of the mediastinum were found to be much more vascular than natural, and, in common with the cellular tissue at the root of the neck, were infiltrated with serosity,

and remarkably tough. There were about four ounces of transparent serosity in the pericardium. Numerous crimson spots, due to sub-pericardial extravasation of blood, were present at the base of the heart, especially about the root of the pulmonary artery; the loose cellular tissue between the ventricles and auricles contained much serosity. Both auricles contained very large coagula; that in the right auricle was continuous with a clot in the coronary sinus. The latter clot, when removed from the sinus, measured three inches in length. The veins on the surface of the heart were gorged with dark-coloured blood. The walls of the heart were greatly hypertrophied, especially those of the right ventricle; they were remarkably hard, tough, and dark in colour. The tissue of the walls was more compact, its cut surface smoother, its edges sharper, and its aspect more transparent than natural. All the cavities of the heart, excepting that of the left ventricle, were extremely capacious. The left auriculo-ventricular orifice was greatly reduced in size, from disease of the mitral valve; the right measured $3\frac{3}{8}$ ths inches in circumference; the aortic orifice, $1\frac{7}{8}$ ths inch; the pulmonary artery, $2\frac{1}{2}$ inches.

The liver, spleen, and kidneys were all loaded with blood, and very tough.

Examined by the aid of the microscope, the muscular fibres of the heart were found to be paler, tougher, and more closely united to each other than natural; they were covered with very fine molecular granules; their transverse striæ were very imperfect. There appeared to be an excess of fibrous tissue in the walls of the heart.

Remarks.—The primary disease in this case was evidently constriction of the mitral orifice, and the duration of the disease three years. The toughness, &c., of the cellular tissue, the state of the liver, spleen, and kidneys, the dilatation of the pulmonary artery, the serosity in the pericardium, the fluid in the cellular tissue at the base of the heart, the dilatation and engorgement with blood of the coronary sinus and the veins on the surface of the heart,

and the sub-pericardial extravasation of blood, were all evidently due to mechanical impediment to the passage of the blood through the left auriculo-ventricular orifice.

The change in the texture of the heart was, as in the preceding, the result of the same cause that produced the change in the texture of the liver, spleen, and kidneys; and the change was of the same nature; only, in the case of the heart, the call on the organ to act was more powerful than in health, and the impediment to the onward flow of the blood necessarily induced over-distension of the cavities behind the impediment.



